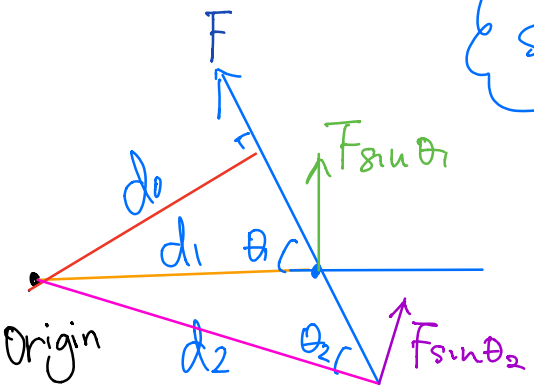
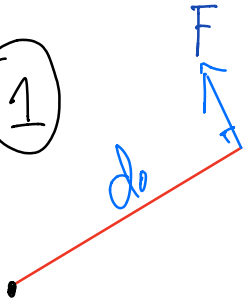
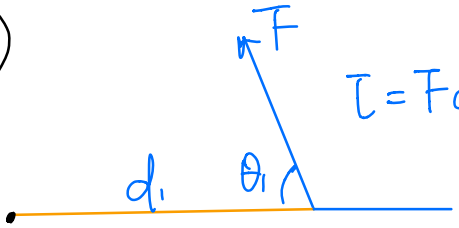
$\sin\theta = \sin(180^\circ - \theta)$

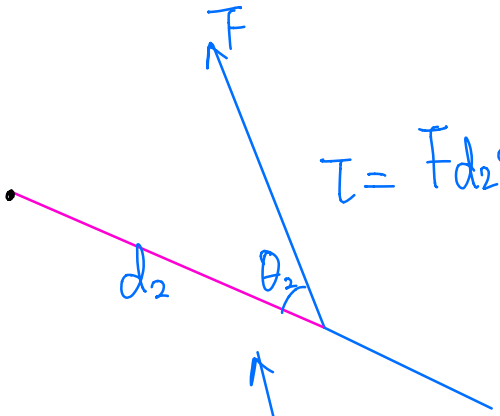


① 

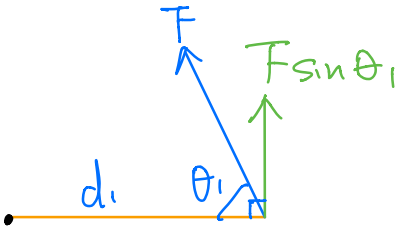
$\tau = Fd_0$

② 

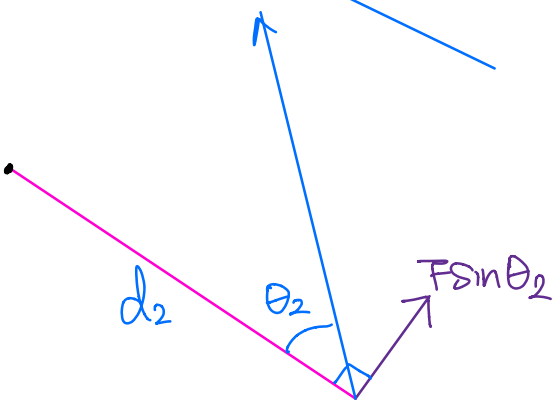
$\tau = Fd_1\sin\theta_1$

③ 

$\tau = Fd_2\sin\theta_2$

④ 

$\tau = F\sin\theta_1\, d_1$
$= Fd_1\sin\theta_1$

⑤ 

$\tau = F\sin\theta_2\, d_2 = Fd_2\sin\theta_2$

$\therefore \tau = Fd_0 = Fd_1\sin\theta_1$
$= Fd_2\sin\theta_2$

20 A car is towed by a truck as shown (Fig r). The weight of the car is 9000 N. The c.g. of the car is marked as G.

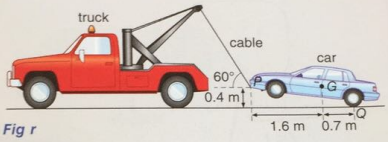
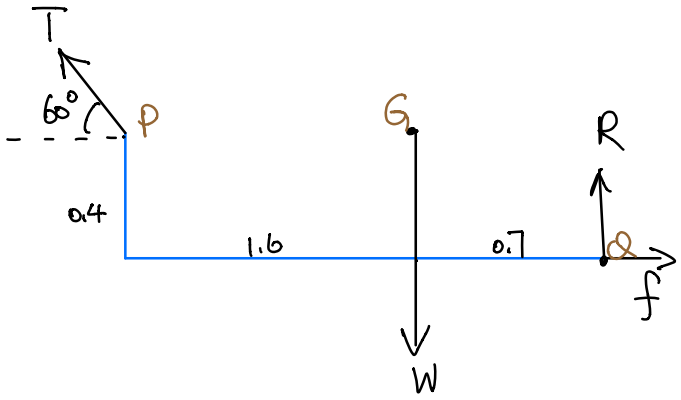


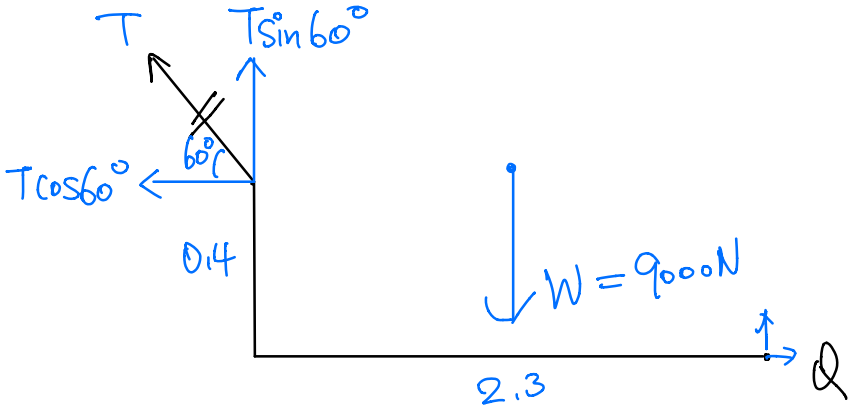
Fig r

(a) The vehicles stop in front of a traffic light. Find the tension in the cable and the normal reaction acting on the car by the road. (4 marks)

(b) The vehicles accelerate from rest and then move at a constant velocity along a straight line. Is the car in equilibrium when it is
(i) accelerating, (1 mark)
(ii) moving at a constant velocity? (1 mark)



(a) Take moment about Q,

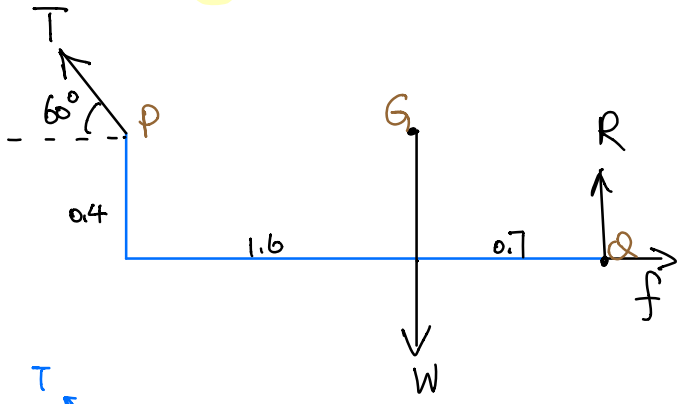


anti clockwise moment = clockwise moment

$$(W)(2.3) + (T\cos 60^\circ)(0.4) = (T\sin 60^\circ)(2.3)$$

$$T = 3516\ N$$

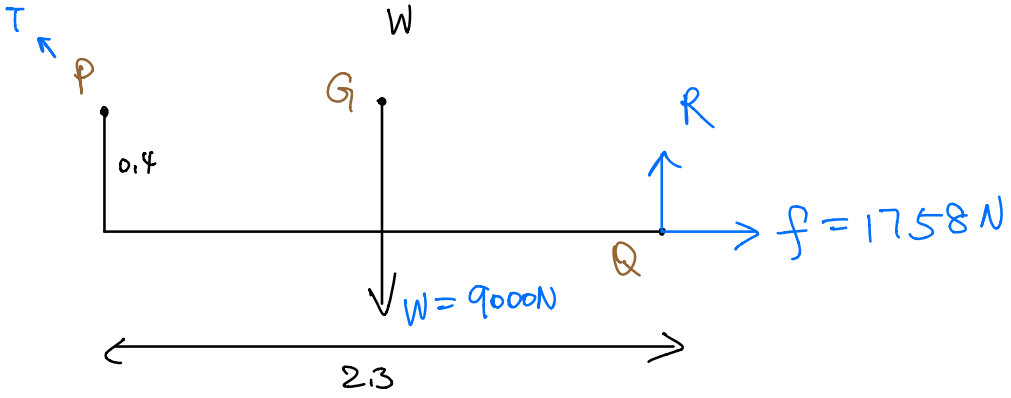
Take moment about P,



$f = T\cos 60°$

$= (3516)(\cos 60°)$

$= 1758\ N$



anti clockwise moment = clockwise moment

$(R)(2.3) + (f)(0.4) = (W)(1.6)$

$R\ 2.3 + (1758)(0.4) = (9000)(1.6)$

$R = 5955.1\ N$